

PATENT ABSTRACTS OF JAPAN

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(54) BATTERY RESIDUAL CAPACITY DETECTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To detect a battery residual capacity with high precision taking the influence of a temperature change into account.

SOLUTION: A control unit 23 makes a switching device 27 select one of tables 30a-30d in a threshold ROM table 30 and output the selected table to a comparator 25 in accordance with whether a portable telephone is in a call state or in a waiting state at present and, further, whether a temperature value obtained via an A/D conversion unit 11 shows a normal temperature or a low temperature. The voltage value of a battery pack 2 is converted by A/D conversion unit 4 and inputted to the comparator 25. The comparator 25 compares a threshold value set in one of the tables 30a-30d in the threshold ROM table 30 which is selected and inputted by the switching device 27 with the voltage value of the battery pack 2 which is inputted via the A/D conversion unit

4 and informs the control unit 23 of the comparison result. The control unit 23 judges a battery residual capacity in accordance with the comparison result of the comparator 25 and displays the battery residual capacity on a display device 8.

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CLAIMS

[Claim(s)]

[Claim 1]A battery residue sensing device which detects a residue of a rechargeable battery formed in a mobile communication terminal, comprising:

A cell voltage detection means to detect cell voltage of said rechargeable battery.

A temperature detecting means which detects temperature.

A threshold storing means stored for every combination of temperature from which a threshold used as a reference value at the time of judging a residue of said rechargeable battery based on cell voltage detected by said cell voltage detection means awaits with the time of communication, and is detected by the time and said temperature detecting means.

A switching means which changes a threshold stored by said threshold storing means according to temperature which awaited with the time of communication and was detected by the time and said temperature detecting means.

A comparison means to judge a residue of said rechargeable battery as compared with a threshold changed by said switching means based on cell voltage detected by said cell voltage detection means.

[Claim 2]ordinary-temperature - awaiting in said threshold storing means -- the time -- the time of ordinary temperature and communication -- low-temperature - awaiting -- the time -- the battery residue sensing device according to claim 1 at the time of low temperature and communication, wherein a threshold corresponding to each is stored.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the residue sensing device which detects the residue of the rechargeable battery which is a power supply, especially relates to the suitable residue sensing device for mobile communication terminals, such as a cellular phone.

[0002]

[Description of the Prior Art] Generally, mobile communication terminals, such as a cellular phone, are equipped with a rechargeable battery as a power supply, and the function which detects the residue (residual time, rate over full capacity) of this rechargeable battery and of which a user is notified is provided. Conventionally, cell voltage is read and detection of battery residue is performed by guessing based on the pressure value.

[0003] With mobile communication terminals, such as a cellular phone, it awaits with the time of a telephone call (communication), and by the time, the

consumed electric current of the mobile communication terminal itself has change, and the cell voltage itself is changed sharply. For this reason, when guessing battery residue, in proportion to the pressure value, it could not be simply considered as battery residue, but it awaited with the time of a telephone call, and the notice of battery residue according to each at the time was needed. In the former, in order to await with the time of a telephone call and to notify the battery residue according to the time, the threshold for judging the battery residue to cell voltage was performed by changing according to the state at that time.

[0004]However, in the conventional battery residue sensing device, since a discharge characteristic changed with the temperature of a cell or the circumference in a rechargeable battery even if it is notifying the battery residue which awaited and took into consideration whether it is at the telephone call time, or it was at the time, the error had occurred in battery residue detection.

[0005]The example of composition of the cellular phone which formed the conventional battery residue sensing device is shown in drawing 4. As shown in drawing 4, the battery pack 2 which is a rechargeable battery which is a power supply of a cellular phone is combined with the portable telephone body 1. The function of a cellular phone is controlled and also the control section 3 which

controls the battery residue detection to the battery pack 2 is formed in the portable telephone body 1. To the portable telephone body 1. The cell voltage value of the battery pack 2. The judgment of the A/D conversion part 4 which digitizes, cell voltage, and battery residue, the comparator 5 which compares the data in the ROM table in which the threshold used as the reference value for carrying out was stored, and the power supply section 6 which supplies the power supply of the battery pack 2 to each part of a cellular phone -- awaiting -- the time -- the time of business and a telephone call --- business -- the switcher 7 and battery residue which change a ROM table to any they are. In order to await and to judge the battery residue at the time, the display for indication 8 which performs the display for notifying, and. Since [which awaits and judges - threshold ROM table 9 and the battery residue at the time of a telephone call] it is referred to. The A/D conversion part 11 which digitizes the temperature value detected by the thermo sensitive register 12 formed in the battery pack 2 for carrying out temperature detection for the surveillance of the abnormalities (charging abnormality etc.) of the telephone call and threshold ROM table 10 referred to, and a cell, the temperature compensating of power amplification, etc. is formed.

[0006]According to whether it is a state of the present cellular phone at the

telephone call time, or await and it is at the time, it awaits to the switcher 7, it changes to any of - threshold ROM table 9, or a telephone call and a threshold ROM table 10 they are, and is made to output to the comparator 5 in the conventional battery residue sensing device.

[0007]The pressure value of the battery pack 2 is changed in the A/D conversion part 4, and is inputted into the comparator 5. The comparator 5 compares the threshold which was inputted from the switcher 7 and which awaited and was set as - threshold ROM table 9, or a telephone call and a threshold ROM table 10 with the pressure value of the battery pack 2 inputted via the A/D conversion part 4, and notifies the result to the control section 3. The control section 3 judges battery residue based on the decision result in the comparator 5, and displays battery residue in the display for indication 8.

[0008]Drawing 5 is awaited for judging the discharge characteristic and battery residue of the battery pack 2 at the time of ordinary temperature and low temperature, and shows the threshold at the time (awaiting - threshold ROM table 9) and the time of a telephone call (a telephone call and threshold ROM table 10). Four steps of levels express battery residue. It expresses that there is so little battery residue that the numerical value of a level is small.

[0009]Among drawing 5, the discharge characteristic of the cell at the time of the

waiting receptacle for ordinary temperature and 16 express the discharge characteristic of the cell at the time of an ordinary temperature telephone call, 17 expresses the discharge characteristic of the cell at the time of the waiting receptacle for low temperature, and 15 express the discharge characteristic of the cell at the time of a low-temperature telephone call 18.

[0010]ab4-ab1 await, the threshold at the time is shown, ab4 awaits, the threshold of the battery residue level 4 at the time and ab3 await, the threshold of the battery residue level 3 at the time and ab2 await, and the threshold of the battery residue level 2 at the time and ab1 await, and they are the thresholds of the battery residue level 1 at the time. cd4-cd1 show the threshold at the time of a telephone call, and, as for the threshold of the battery residue level 4 at the time of a telephone call, and cd3, the threshold of the battery residue level 2 at the time of a telephone call and cd1 are the thresholds of the battery residue level 1 at the time of a telephone call cd4 the threshold of the battery residue level 3 at the time of a telephone call, and cd2.

[0011]Next, the operation in the conventional battery residue sensing device is explained, referring to drawing 4 and drawing 5. First, explanation in the time of the waiting receptacle for ordinary temperature is given. Here, it explains that cell voltage is the voltage of the point a shown in drawing 5.

[0012]Since the control section 3 performs control of a waiting receptacle or a telephone call, the present situation awaits it and whether it is at the time or the telephone call time can judge it. Since the control section 3 awaits and makes the battery residue at the time detect, it makes the threshold which awaited and was stored in - threshold ROM table 9 output to the comparator 5 to the switcher 7.

[0013]the control section 3 awaits with the cell voltage in the point a inputted via the A/D conversion part 4 obtained by the comparator 5, and a comparison result with the threshold of the battery residue levels 4-1 (ab4-ab1) at the time to its battery residue is equivalent to the battery residue level 2 (ab2) -- then, it judges.

[0014]From this state, when a telephone call is started, cell voltage falls with the characteristic of a cell and shifts to the point b. The switcher 7 is received in order for the control section 3 to make the battery residue at the time of a telephone call detect by having changed from the waiting receptacle to a telephone call, The threshold stored in the telephone call and threshold ROM table 10 is made to output to the comparator 5, the threshold which the comparator 5 uses for the judgment of battery residue is awaited, and it changes from the battery residue levels 4-1 (ab4-ab1) at the time to the battery residue

levels 4-1 (cd4-cd1) at the time of a telephone call.

[0015]this time -- the control section 3 has battery residue equivalent to the battery residue level 2 (cd2), then it judges it on it. On the other hand, when it awaits and is sometimes in a cold condition, cell voltage falls to the point c with the characteristic of a cell.

[0016]in this case, the control section 3 is considerable from the result of having awaited the battery residue in the point c and having measured it with the battery residue levels 4-1 (ab4-ab1) at the time to the battery residue level 2 (ab2) -- then, it can judge.

[0017]From this state, when a telephone call is started, cell voltage falls with the characteristic of a cell and shifts to the point d. By having changed from the waiting receptacle at the time of a telephone call, the control section 3 also awaits a threshold and is changed from the battery residue levels 4-1 (ab4-ab1) at the time to the battery residue levels 4-1 (cd4-cd1) at the time of a telephone call. At this time, the control section 3 has battery residue equivalent to different pond residue level 1 (cd1) from the decision result in the time of an ordinary temperature telephone call, then it judges it to it.

[0018]

[Problem(s) to be Solved by the Invention]Thus, in the conventional battery

residue sensing device, it awaited, and awaited with the time of a telephone call by awaiting and changing - threshold ROM table 9, and a telephone call and a threshold ROM table 10 according to whether it is at the time, or it is at the telephone call time, and the battery residue according to the time was notified.

[0019]However, as mentioned above, even if it was a case in ordinary temperature where it awaited, low temperature awaited at the time and the time of a telephone call, and battery residue was judged in the time to be the battery residue level 2, in the time of a low-temperature telephone call, it was judged with battery residue level 1, and there was a case where battery residue could not be notified correctly.

[0020]In the time of a low-temperature telephone call, as shown in the battery residue display at the time of the low-temperature telephone call shown in drawing 5, the problem that the ratio of the duration of call of the battery residue levels 4-1 did not become equivalent had occurred.

[0021]That is, in the conventional battery residue sensing device, since the discharge characteristic which changes with the temperature of a rechargeable battery was not taken into consideration, battery residue was not able to be correctly notified only by measuring cell voltage. In particular, in the time of a telephone call, the consumed electric current awaited, since it was larger than

the time, the difference of the discharge characteristic with the time of ordinary temperature and low temperature became large (for the internal resistance of a cell, the contact resistance of connectors, etc.), and influence was large to the judgment of battery residue.

[0022] This invention was made in consideration of the above situations, and an object of this invention is to provide the battery residue sensing device which can detect battery residue with sufficient accuracy in consideration of the influence by a temperature change.

[0023]

[Means for Solving the Problem] As opposed to cell voltage detected from a rechargeable battery with which this invention was provided in a mobile telecom terminal, By awaiting a threshold used as a reference value at the time of judging a residue of a rechargeable battery which awaited with the time of communication and was prepared for every combination of the time and temperature with the time of communication, and changing it to the time according to temperature. A judgment in consideration of the discharge characteristic of a rechargeable battery which awaits with the time of communication and changes not only with a difference at the time but with temperature of a residue of a rechargeable battery is performed.

[0024]

[Embodiment of the Invention] Hereafter, an embodiment of the invention is described with reference to drawings. Drawing 1 shows the example of composition of the cellular phone which formed the battery residue sensing device in an embodiment of the invention.

[0025] The same numerals are attached about the same component part as drawing 4 used for explanation of a Prior art. As shown in drawing 1, the battery pack 2 of the rechargeable battery which is a power supply of a cellular phone is combined with the portable telephone body 20. The function of a cellular phone is controlled and also the control section 23 which controls the battery residue detection to the battery pack 2 is formed in the portable telephone body 20. To the portable telephone body 20, the cell voltage value of the battery pack 2. The judgment of the A/D conversion part 4 which digitizes, cell voltage, and battery residue, the comparator 25 which compares the data in threshold ROM table 30 in which the threshold used as the reference value for carrying out was stored, and the power supply section 6 which supplies the power supply of the battery pack 2 to each part of a cellular phone -- it awaiting and for every combination of the time, the time of a telephone call (telephone call), and temperature. The threshold used as the reference value at the time of judging the residue of the

battery pack 2 based on the display for indication 8 and cell voltage which perform the display for notifying the switcher 27 and battery residue which change threshold ROM table 30 in which the threshold used as the reference value at the time of judging the residue of the battery pack 2 was stored, The others which are surveillance of the abnormalities (charging abnormality etc.) of threshold ROM table 30 and a cell, temperature compensating of power amplification, etc. which awaited with the time of communication and were stored for every combination of the time and temperature (predetermined temperature applicable to ordinary temperature and low temperature), In order to change the threshold for judging the battery residue in the comparator 25, the A/D conversion part 11 which digitizes the temperature value detected by the thermo sensitive register 12 formed in the battery pack 2 for carrying out temperature detection is formed.

[0026]In addition -- ordinary-temperature - awaiting to threshold ROM table 30 - threshold ROM table 30a, and ordinary temperature, a telephone call and a threshold ROM table 30b -- it low-temperature - awaits and - threshold ROM table 30c, and low temperature, a telephone call and a threshold ROM table 30d are formed.

[0027]In the residue sensing device in this embodiment, await whether it is a

state of the present cellular phone at the telephone call time, and. [whether it is at the time, and] The control section 23 changes to which tables 30a-30d in threshold ROM table 30 to the switcher 25, and makes it output to the comparator 25 according to any the temperature value furthermore acquired via the A/D conversion part 11 shall show between ordinary temperature and low temperature.

[0028]The pressure value of the battery pack 2 is changed in the A/D conversion part 4, and is inputted into the comparator 25. The comparator 25 compares the threshold set as which tables 30a-30d in threshold ROM table 30 inputted from the switcher 27 with the pressure value of the battery pack 2 inputted via the A/D conversion part 4, and notifies the result to the control section 23. The control section 23 judges battery residue based on the decision result in the comparator 25, and displays battery residue in the display for indication 8.

[0029]Drawing 2 is awaited for judging battery residue to be the discharge characteristic of the battery pack 2 at the time of ordinary temperature and low temperature, and shows the threshold for every combination of the time, the time of a telephone call, and temperature (ordinary temperature, low temperature).

[0030]Temporarily, by the telephone call of ordinary temperature, for 120 minutes, the cell which has capacity for 100 minutes is made into an example,

and is explained by low-temperature telephone call. When the level of battery residue is divided into 4-1, the capacity of a cell starts a telephone call from a full charge and time to the operating limit voltage due to sag is made into 100%, 100 to 75%, the level 2 makes the level 3 75% - 50%, and is made into 50% - 25%, and level 1 makes the level 4 25% - 0%.

[0031]Among drawing 5, the discharge characteristic of the cell at the time of the waiting receptacle for ordinary temperature and 16 express the discharge characteristic of the cell at the time of an ordinary temperature telephone call, 17 expresses the discharge characteristic of the cell at the time of the waiting receptacle for low temperature, and 15 express the discharge characteristic of the cell at the time of a low-temperature telephone call 18.

[0032]a4-a1 show the threshold at the time of the waiting receptacle for ordinary temperature, and, as for the threshold of the battery residue level 4 at the time of the waiting receptacle for ordinary temperature, and a3, the threshold of the battery residue level 2 at the time of the waiting receptacle for ordinary temperature and a1 are the thresholds of the battery residue level 1 at the time of the waiting receptacle for ordinary temperature a4 the threshold of the battery residue level 3 at the time of the waiting receptacle for ordinary temperature, and a2. b4-b1 show the threshold at the time of an ordinary temperature telephone

call, and, as for the threshold of the battery residue level 4 at the time of an ordinary temperature telephone call, and b3, the threshold of the battery residue level 2 at the time of an ordinary temperature telephone call and b1 are the thresholds of the battery residue level 1 at the time of an ordinary temperature telephone call b4 the threshold of the battery residue level 3 at the time of an ordinary temperature telephone call, and b2. c4-c1 show the threshold at the time of the waiting receptacle for low temperature, and, as for the threshold of the battery residue level 4 at the time of the waiting receptacle for low temperature, and c3, the threshold of the battery residue level 2 at the time of the waiting receptacle for low temperature and c1 are the thresholds of the battery residue level 1 at the time of the waiting receptacle for low temperature c4 the threshold of the battery residue level 3 at the time of the waiting receptacle for low temperature, and c2. d4-d1 show the threshold at the time of a low-temperature telephone call, and, as for the threshold of the battery residue level 4 at the time of a low-temperature telephone call, and d3, the threshold of the battery residue level 2 at the time of a low-temperature telephone call and d1 are the thresholds of the battery residue level 1 at the time of a low-temperature telephone call d4 the threshold of the battery residue level 3 at the time of a low-temperature telephone call, and d2.

[0033]Next, the operation in the battery residue sensing device in this embodiment is explained, referring to drawing 1 thru/or drawing 3. First, explanation in the time of the waiting receptacle for ordinary temperature is given. Here, it explains that cell voltage is the voltage of the point a shown in drawing 2.

[0034]The control section 23 has detected temperature by acquiring the pressure value of the thermo sensitive register 12 provided in the battery pack 2 via the A/D conversion part 11. As a result, the control section 23 should judge it as the thing in a room temperature condition now.

[0035]Since the control section 23 performs control of a waiting receptacle or a telephone call, the present situation awaits it and whether it is at the time or the telephone call time can judge it. Since the control section 23 makes the battery residue at the time of the waiting receptacle for ordinary temperature detect, it makes the ordinary temperature and the threshold which awaited and was stored in - threshold ROM table 30a of threshold ROM table 30 output to the comparator 25 to the switcher 27.

[0036]The comparator 25 compares with the threshold of the battery residue levels 4-1 (a4-a1) at the time of ordinary temperature ***** the cell voltage in the point a inputted via the A/D conversion part 4, and notifies the result to the control section 23. From the comparison result obtained by the comparator 25,

the control section 23 has battery residue equivalent to the battery residue level

2 (a2), then it judges it on it.

[0037]The control section 23 performs the display for notifying battery residue to

the display for indication 8 according to the decision result of a battery residue

level. For example, the gestalt which expresses four steps of levels as shown in

drawing 3 with the battery residue sensing device in this embodiment notifies

battery residue. Here, since it was judged with the battery residue level 2, the

display shown in drawing 3 (c) is performed. The display of battery residue may

always be performed, and it may be made to carry out if needed (for example,

when there are directions of a battery residue display etc.).

[0038]From this state, when a telephone call is started, cell voltage falls with the

characteristic of a cell and shifts to the point b. The switcher 27 is received in

order for the control section 23 to make the battery residue at the time of a

telephone call detect by having changed from the waiting receptacle to a

telephone call, The threshold stored in ordinary temperature, the telephone call,

and threshold ROM table 30b is made to output to the comparator 25, and the

comparator 25 awaits the threshold used for the judgment of battery residue,

and changes it from the battery residue levels 4-1 (a4-a1) at the time to the

battery residue levels 4-1 (b4-b1) at the time of a telephone call.

[0039]a basis [comparison result / using the battery residue levels / in / at this time / in the control section 23 / the comparator 25 / 4-1 (b4-b1)] -- battery residue is equivalent to the battery residue level 2 (b2), then judges on it.

[0040]On the other hand, when it awaits and is sometimes in a cold condition, cell voltage falls to the point c with the characteristic of a cell. The control section 23 judges it as the thing in a cold condition, as a result of acquiring the voltage of the thermo sensitive register 12 in the battery pack 2 via the A/D conversion part 11.

[0041]Since the control section 23 makes the battery residue at the time of the waiting receptacle for low temperature detect, it makes the low temperature and the threshold which awaited and was stored in - threshold ROM table 30c of threshold ROM table 30 output to the comparator 25 to the switcher 27.

[0042]The comparator 25 compares with the threshold of the battery residue levels 4-1 (c4-c1) at the time of low-temperature ***** the cell voltage in the point c inputted via the A/D conversion part 4, and notifies the result to the control section 23. From the comparison result obtained by the comparator 25, the control section 23 has battery residue equivalent to the same battery residue level 2 (a2) as the time of ordinary temperature, then it judges it on it.

[0043]From this state, when a telephone call is started, cell voltage falls with the

characteristic of a cell and shifts to the point d. The switcher 27 is received in order for the control section 23 to make the battery residue at the time of a telephone call detect by having changed from the waiting receptacle to a telephone call, The threshold stored in low temperature, the telephone call, and threshold ROM table 30d is made to output to the comparator 25, and the comparator 25 awaits the threshold used for the judgment of battery residue, and changes it from the battery residue levels 4-1 (c4-c1) at the time to the battery residue levels 4-1 (d4-d1) at the time of a telephone call.

[0044]At this time, based on the comparison result using the battery residue levels 4-1 (d4-d1) in the comparator 25, the control section 23 has battery residue equivalent to the same battery residue level 2 (d2) as the time of ordinary temperature, then it judges it on it.

[0045]Thus, temperature is detected by reading the voltage of the thermo sensitive register 12 formed in the battery pack 2, or [whether it is among a current telephone, or / that it awaits and is inside] -- in addition, since the tables 30a-30d in threshold ROM table 30 are changed and it is made to output to the comparator 25 by the switcher 27 according to whether it is at the ordinary temperature time, or it is at the low-temperature time, the battery residue in consideration of a temperature change can be judged. Therefore, even if it

awaits and is in which state of the combination of the time, and ordinary temperature or low temperature at the time of a telephone call as mentioned above since it becomes detectable [the battery residue which is not influenced by the temperature change], a battery residue level can be judged to be the level 2.

[0046]At the time of a low-temperature telephone call, as shown in the battery residue display at the time of the low-temperature telephone call shown in drawing 2, the ratio of the duration of call of the battery residue levels 4-1 becomes equivalent, and it becomes possible to take consistency of battery residue and duration of call.

[0047]Although two steps of temperature, at the time of ordinary temperature and low temperature, are made into an example and explained by explanation mentioned above, of course, it is possible to be aimed at the temperature more than a three-stage. In this case, the threshold is stored in threshold ROM table 30 for every group each temperature more than a three-stage, a waiting receptacle, and under telephone call, a threshold is changed according to the temperature detected using the thermo sensitive register 12, and battery residue is judged.

[0048]Although the battery residue sensing device formed in the cellular phone

is made into an example and explained by explanation mentioned above, if it is the mobile communication terminal in which the rechargeable battery was formed, it is possible to apply also to apparatus other than a cellular phone.

[0049]

[Effect of the Invention]As opposed to the cell voltage which was detected from the rechargeable battery formed in the mobile telecom terminal according to this invention as explained in full detail above, By awaiting the threshold used as the reference value at the time of judging the residue of the rechargeable battery which awaited with the time of communication and was prepared for every combination of the time and temperature with the time of communication, and changing it to the time according to temperature. Since the residue of the rechargeable battery in consideration of the discharge characteristic of the rechargeable battery which awaits with the time of communication and changes not only with the difference at the time but with temperature is judged, battery residue can be detected without receiving the influence by a temperature change.

DESCRIPTION OF DRAWINGS

957643/D/1

[Brief Description of the Drawings]

[Drawing 1]The figure showing the example of composition of the cellular phone which formed the battery residue sensing device in an embodiment of the invention.

[Drawing 2]The figure for judging battery residue to be the discharge characteristic of the battery pack 2 at the time of ordinary temperature and low temperature in which awaiting and showing the threshold for every combination of the time, the time of a telephone call, and temperature (ordinary temperature, low temperature).

[Drawing 3]The figure showing an example of the display for notifying battery residue.

[Drawing 4]The figure showing the example of composition of the cellular phone which formed the conventional battery residue sensing device.

[Drawing 5]The figure for judging the discharge characteristic and battery residue of the battery pack 2 at the time of ordinary temperature and low temperature in which awaiting and showing the threshold at the time and the time of a telephone call.

[Description of Notations]

2 -- Battery pack

4	--	A/D	conversion	part
6	--	Power	supply	section
8	--	Display	for	indication
11	--	A/D	conversion	part
12	--	Thermo	sensitive	register
20	--	Portable	telephone	body
23	--		Control	section
25		---		Comparator
27		--		Switcher
30	--	Threshold	ROM	table

It 30a-- ordinary-temperature - Awaits, and is - threshold ROM table.

30b -- Ordinary temperature, a telephone call, and threshold ROM table

It 30c-- low-temperature - Awaits, and is - threshold ROM table.

30d -- Low temperature, a telephone call, and threshold ROM table

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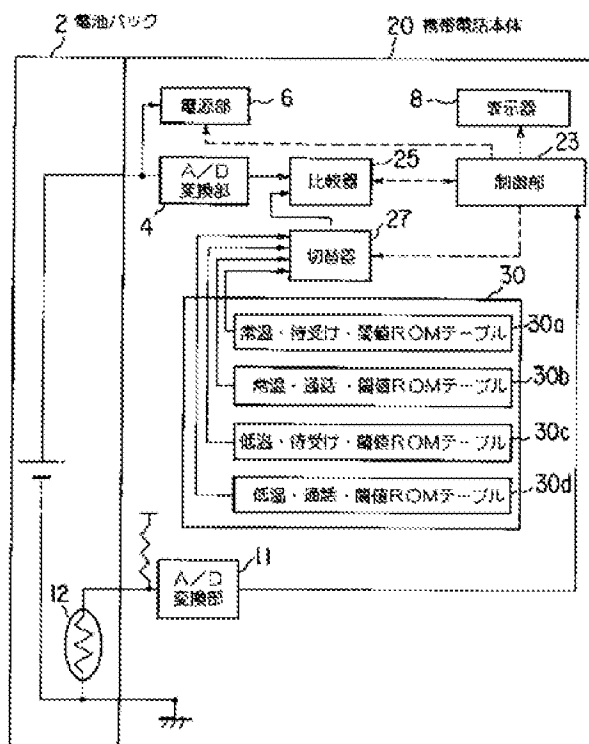
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(54)【発明の名称】 電池残量検出装置

(57)【要約】

【課題】 温度変化による影響を考慮して精度良く電池残量を検出することを可能にする。

【解決手段】 現在の携帯電話の状態が通話時であるか待ち受け時であるか、さらにA/D変換部11を介して得られる温度値が常温、低温の何れを示すかに応じて、制御部23が切替器27に対して閾値ROMテーブル30中の何れかのテーブル30a~30dに切り替えて比較器25に出力させる。電池パック2の電圧値は、A/D変換部4で変換されて比較器25に入力される。比較器25は、切替器27から入力した閾値ROMテーブル30中の何れかのテーブル30a~30dに設定された閾値と、A/D変換部4を介して入力された電池パック2の電圧値とを比較してその結果を制御部23に通知する。制御部23は、比較器25における判定結果に基づいて電池残量を判定し、表示器8において電池残量を表示させる。



【特許請求の範囲】

【請求項1】 移動通信端末に設けられた二次電池の残量を検出する電池残量検出装置において、

前記二次電池の電池電圧を検出する電池電圧検出手段と、

温度を検出する温度検出手段と、

前記電池電圧検出手段によって検出された電池電圧をもとに前記二次電池の残量を判定する際の基準値となる閾値が、通信時と待ち受け時と前記温度検出手段によって検出される温度の組合わせ毎に格納された閾値格納手段と、

前記閾値格納手段によって格納された閾値を、通信時と待ち受け時と前記温度検出手段によって検出された温度に応じて切り替える切替手段と、

前記電池電圧検出手段によって検出された電池電圧をもとに、前記切替手段によって切り替えられた閾値と比較して前記二次電池の残量を判定する比較手段とを具備したことを特徴とする電池残量検出装置。

【請求項2】 前記閾値格納手段には、常温・待ち受け時、常温・通信時、低温・待ち受け時、低温・通信時のそれぞれに対応する閾値が格納されたことを特徴とする請求項1記載の電池残量検出装置。

【発明の詳細な説明】**【0001】**

【発明の属する技術分野】 本発明は、電源である二次電池の残量を検出する残量検出装置に係り、特に携帯電話等の移動通信端末に好適な残量検出装置に関する。

【0002】

【従来の技術】 一般に、携帯電話等の移動通信端末には、電源として二次電池が装備され、この二次電池の残量（残り時間、全容量に対する割合）を検出してユーザに通知する機能が設けられている。従来、電池残量の検出は、電池電圧を読取り、その電圧値を基に推測することにより行われている。

【0003】 携帯電話等の移動通信端末では、通話（通信）時と待ち受け時では、移動通信端末自体の消費電流に変化があり、電池電圧自体が大きく変動する。このため、電池残量を推測する時、単純に電圧値に比例して電池残量とすることができず、通話時と待ち受け時のそれぞれに応じた電池残量の通知が必要となっていた。従来では、通話時と待ち受け時に応じた電池残量の通知を行なうために、電池電圧に対する電池残量を判定するための閾値を、その時の状態により切り替えることにより行っていた。

【0004】 しかしながら、従来の電池残量検出装置では、通話時であるか待ち受け時であるかを考慮した電池残量の通知を行っていても、二次電池が電池あるいは周囲の温度によって放電特性が変化するため、電池残量検出に誤差が発生していた。

【0005】 図4には、従来の電池残量検出装置を設け

た携帯電話の構成例を示している。図4に示すように、携帯電話本体1には、携帯電話の電源である二次電池である電池パック2が結合される。携帯電話本体1には、携帯電話の機能の制御を行なう他、電池パック2に対する電池残量検出を制御する制御部3が設けられている。また、携帯電話本体1には、電池パック2の電池電圧値をデジタル化するA/D変換部4、電池電圧と電池残量の判定を行なうための基準値となる閾値が格納されたROMテーブル中のデータとを比較する比較器5、電池パック2の電源を携帯電話の各部に供給する電源部6、待ち受け時用と通話時用の何れかにROMテーブルを切り替える切替器7、電池残量を通知するための表示を行なう表示器8、待ち受け時の電池残量を判定するために参照される待受け・閾値ROMテーブル9、通話時の電池残量を判定するために参照される通話・閾値ROMテーブル10、電池の異常（充電異常等）の監視やパワーアンプの温度補償等のために温度検出するための電池パック2に設けられたサーミスタ12によって検知される温度値をデジタル化するA/D変換部11が設けられている。

【0006】 従来の電池残量検出装置では、現在の携帯電話の状態が通話時であるか待ち受け時であるかに応じて、切替器7に対して待受け・閾値ROMテーブル9または通話・閾値ROMテーブル10の何れかに切り替えて比較器5に出力させる。

【0007】 電池パック2の電圧値は、A/D変換部4で変換されて比較器5に入力される。比較器5は、切替器7から入力した待受け・閾値ROMテーブル9あるいは通話・閾値ROMテーブル10に設定された閾値と、A/D変換部4を介して入力された電池パック2の電圧値とを比較してその結果を制御部3に通知する。制御部3は、比較器5における判定結果に基づいて電池残量を判定し、表示器8において電池残量を表示させる。

【0008】 図5は、常温時と低温時の電池パック2の放電特性と電池残量を判定するための待ち受け時（待受け・閾値ROMテーブル9）と通話時（通話・閾値ROMテーブル10）の閾値を示している。なお、電池残量を4段階のレベルによって表している。レベルの数値が小さい程、電池残量が少ないことを表している。

【0009】 図5中、15は常温待ち受け時の電池の放電特性、16は常温通話時の電池の放電特性、17は低温待ち受け時の電池の放電特性、18は低温通話時の電池の放電特性を表している。

【0010】 また、a b 4～a b 1は待ち受け時の閾値を示しており、a b 4は待ち受け時の電池残量レベル4の閾値、a b 3は待ち受け時の電池残量レベル3の閾値、a b 2は待ち受け時の電池残量レベル2の閾値、a b 1は待ち受け時の電池残量レベル1の閾値である。また、c d 4～c d 1は通話時の閾値を示しており、c d 4は通話時の電池残量レベル4の閾値、c d 3は通話時

の電池残量レベル3の閾値、cd2は通話時の電池残量レベル2の閾値、cd1は通話時の電池残量レベル1の閾値である。

【0011】次に、従来の電池残量検出装置における動作について、図4と図5を参照しながら説明をする。まず、常温待ち受け時での説明をする。ここでは、電池電圧が図5中に示すポイントaの電圧であるとして説明する。

【0012】制御部3は、待ち受けや通話の制御を行うので、現在の状況が待ち受け時か通話時であるかは判定できる。制御部3は、待ち受け時の電池残量を検知させるために切替器7に対して、待受け・閾値ROMテーブル9に格納された閾値を比較器5へ出力させる。

【0013】制御部3は、比較器5により得られた、A/D変換部4を介して入力したポイントaにおける電池電圧と、待受け時の電池残量レベル4～1(ab4～ab1)の閾値との比較結果から、電池残量が電池残量レベル2(ab2)に相当すると判定する。

【0014】この状態から、通話に入った場合は、電池電圧が電池の特性により低下しポイントbに移行する。制御部3は、待ち受けから通話にかかったことにより、通話時の電池残量を検知させるために切替器7に対して、通話・閾値ROMテーブル10に格納された閾値を比較器5へ出力させ、比較器5が電池残量の判定に用いる閾値を待ち受け時の電池残量レベル4～1(ab4～ab1)から通話時の電池残量レベル4～1(cd4～cd1)に切り替える。

【0015】この時、制御部3は、電池残量が電池残量レベル2(cd2)に相当すると判定する。一方、待ち受け時に低温状態になった場合、電池電圧は電池の特性によりポイントcまで低下する。

【0016】この場合、制御部3は、ポイントcでの電池残量を、待受け時の電池残量レベル4～1(ab4～ab1)と比較した結果から、電池残量レベル2(ab2)に相当すると判定できる。

【0017】この状態から、通話に入った場合は、電池電圧が電池の特性により低下しポイントdに移行する。制御部3は、待ち受けから通話時にかかったことにより、閾値も待ち受け時の電池残量レベル4～1(ab4～ab1)から通話時の電池残量レベル4～1(cd4～cd1)に切り替える。この時、制御部3は、電池残量が常温通話時での判定結果とは異なる電池残量レベル1(cd1)に相当すると判定する。

【0018】

【発明が解決しようとする課題】このように従来の電池残量検出装置では、待ち受け時であるか通話時であるかに応じて、待受け・閾値ROMテーブル9と通話・閾値ROMテーブル10を切り替えることで通話時と待ち受け時に応じた電池残量の通知を行っていた。

【0019】しかしながら前述したように、常温での待

ち受け時と通話時、低温の待ち受け時では電池残量が電池残量レベル2と判定される場合であっても、低温通話時では電池残量レベル1と判定され、正しく電池残量を通知できない場合があった。

【0020】また、低温通話時では、図5に示す低温通話時の電池残量表示に示すように、電池残量レベル4～1の通話時間の比率が均等にならないという問題が発生していた。

【0021】つまり、従来の電池残量検出装置では、二次電池の温度によって変化する放電特性を考慮していないために、電池電圧を測定するだけでは正しく電池残量を通知することができなかった。特に、通話時では、消費電流が待ち受け時よりも大きいため、常温時と低温時との放電特性の差が大きくなり（電池の内部抵抗やコネクタ類の接触抵抗等のため）、電池残量の判定に対して影響が大きくなっていた。

【0022】本発明は前記のような事情を考慮してなされたもので、温度変化による影響を考慮して精度良く電池残量を検出することが可能な電池残量検出装置を提供することを目的とする。

【0023】

【課題を解決するための手段】本発明は、移動体通信端末に設けられた二次電池から検出された電池電圧に対して、通信時と待ち受け時と温度の組合わせ毎に用意された二次電池の残量を判定する際の基準値となる閾値を、通信時と待ち受け時と温度に応じて切り替えることで、通信時と待ち受け時の違いだけでなく、温度によって変化する二次電池の放電特性を考慮した二次電池の残量の判定が行われる。

【0024】

【発明の実施の形態】以下、図面を参照して本発明の実施の形態について説明する。図1は本発明の実施の形態における電池残量検出装置を設けた携帯電話の構成例を示している。

【0025】なお、従来の技術の説明に用いた図4と同じ構成部分については同一の符号を付している。図1に示すように、携帯電話本体20には、携帯電話の電源である二次電池の電池パック2が結合される。携帯電話本体20には、携帯電話の機能の制御を行なう他、電池パック2に対する電池残量検出を制御する制御部23が設けられている。また、携帯電話本体20には、電池パック2の電池電圧値をデジタル化するA/D変換部4、電池電圧と電池残量の判定を行なうための基準値となる閾値が格納された閾値ROMテーブル30中のデータとを比較する比較器25、電池パック2の電源を携帯電話の各部に供給する電源部6、待ち受け時と通話（通話）時と温度の組合わせ毎に、電池パック2の残量を判定する際の基準値となる閾値が格納された閾値ROMテーブル30を切り替える切替器27、電池残量を通知するための表示を行なう表示器8、電池電圧をもとに電池パッ

ク2の残量を判定する際の基準値となる閾値が、通信時と待ち受け時と温度（常温と低温に該当する所定の温度）の組合わせ毎に格納された閾値ROMテーブル30、電池の異常（充電異常等）の監視やパワーアンプの温度補償等の他、比較器25における電池残量の判定を行なうための閾値を切り替えるために温度検出するための電池パック2に設けられたサーミスタ12によって検知される温度値をディジタル化するA/D変換部11が設けられている。

【0026】なお、閾値ROMテーブル30には、常温・待受け・閾値ROMテーブル30a、常温・通話・閾値ROMテーブル30b、低温・待受け・閾値ROMテーブル30c、低温・通話・閾値ROMテーブル30dが設けられている。

【0027】本実施形態における残量検出装置では、現在の携帯電話の状態が通話時であるか待ち受け時であるか、さらにA/D変換部11を介して得られる温度値が常温、低温の何れを示すかに応じて、制御部23が切替器25に対して閾値ROMテーブル30中の何れかのテーブル30a～30dに切り替えて比較器25に出力させる。

【0028】電池パック2の電圧値は、A/D変換部4で変換されて比較器25に入力される。比較器25は、切替器27から入力した閾値ROMテーブル30中の何れかのテーブル30a～30dに設定された閾値と、A/D変換部4を介して入力された電池パック2の電圧値とを比較してその結果を制御部23に通知する。制御部23は、比較器25における判定結果に基づいて電池残量を判定し、表示器8において電池残量を表示させる。

【0029】図2は、常温時と低温時の電池パック2の放電特性と、電池残量を判定するための待ち受け時と通話時と温度（常温、低温）の組合わせ毎の閾値を示している。

【0030】仮に、常温の通話で120分間、低温の通話で100分間容量がある電池を例にして説明する。また、電池残量のレベルを4～1に区切り電池の容量が満充電から通話を開始し、電圧低下による動作限界電圧までの時間を100%とした場合、レベル4は100～75%、レベル3は75%～50%、レベル2は50%～25%、レベル1は25%～0%とする。

【0031】図5中、15は常温待ち受け時の電池の放電特性、16は常温通話時の電池の放電特性、17は低温待ち受け時の電池の放電特性、18は低温通話時の電池の放電特性を表している。

【0032】また、a4～a1は常温待ち受け時の閾値を示しており、a4は常温待ち受け時の電池残量レベル4の閾値、a3は常温待ち受け時の電池残量レベル3の閾値、a2は常温待ち受け時の電池残量レベル2の閾値、a1は常温待ち受け時の電池残量レベル1の閾値である。b4～b1は常温通話時の閾値を示しており、b

4は常温通話時の電池残量レベル4の閾値、b3は常温通話時の電池残量レベル3の閾値、b2は常温通話時の電池残量レベル2の閾値、b1は常温通話時の電池残量レベル1の閾値である。c4～c1は低温待ち受け時の閾値を示しており、c4は低温待ち受け時の電池残量レベル4の閾値、c3は低温待ち受け時の電池残量レベル3の閾値、c2は低温待ち受け時の電池残量レベル2の閾値、c1は低温待ち受け時の電池残量レベル1の閾値である。d4～d1は低温通話時の閾値を示しており、d4は低温通話時の電池残量レベル4の閾値、d3は低温通話時の電池残量レベル3の閾値、d2は低温通話時の電池残量レベル2の閾値、d1は低温通話時の電池残量レベル1の閾値である。

【0033】次に、本実施形態における電池残量検出装置における動作について、図1乃至図3を参照しながら説明をする。まず、常温待ち受け時での説明をする。ここでは、電池電圧が図2中に示すポイントaの電圧であるとして説明する。

【0034】制御部23は、電池パック2に設けられたサーミスタ12の電圧値を、A/D変換部11を介して取得することによって温度を検出している。この結果、制御部23は、現在、常温状態にあるものと判断したものとする。

【0035】また、制御部23は、待ち受けや通話の制御を行うので、現在の状況が待ち受け時か通話時であるかは判定できる。制御部23は、常温待ち受け時の電池残量を検知させるために切替器27に対して、閾値ROMテーブル30の常温・待受け・閾値ROMテーブル30aに格納された閾値を比較器25に出力させる。

【0036】比較器25は、A/D変換部4を介して入力したポイントaにおける電池電圧と、常温待ち受け時の電池残量レベル4～1（a4～a1）の閾値とを比較し、その結果を制御部23に通知する。制御部23は、比較器25により得られた比較結果から、電池残量が電池残量レベル2（a2）に相当すると判定する。

【0037】制御部23は、電池残量レベルの判定結果に応じて、表示器8に電池残量を知するための表示を行なう。例えば、本実施形態における電池残量検出装置では、図3に示すような、4段階のレベルを表す形態によって電池残量を知する。ここでは、電池残量レベル2と判定されたので、図3（c）に示す表示が行われる。なお、電池残量の表示は、常時行っても良いし、必要に応じて（例えば電池残量表示の指示があった場合等）行なうようにしても良い。

【0038】この状態から、通話に入った場合は、電池電圧が電池の特性により低下しポイントbに移行する。制御部23は、待ち受けから通話に変わったことにより、通話時の電池残量を検知させるために切替器27に対して、常温・通話・閾値ROMテーブル30bに格納された閾値を比較器25へ出力させ、比較器25が電池

残量の判定に用いる閾値を、待ち受け時の電池残量レベル4～1（a4～a1）から通話時の電池残量レベル4～1（b4～b1）に切り替える。

【0039】この時、制御部23は、比較器25における電池残量レベル4～1（b4～b1）を用いた比較結果をもとに、電池残量が電池残量レベル2（b2）に相当すると判定する。

【0040】一方、待ち受け時に低温状態になった場合、電池電圧は電池の特性によりポイントcまで低下する。制御部23は、電池パック2内のサーミスタ12の電圧をA/D変換部11を介して取得した結果、低温状態にあるものと判断する。

【0041】制御部23は、低温待ち受け時の電池残量を検知させるために切替器27に対して、閾値ROMテーブル30の低温・待受け・閾値ROMテーブル30cに格納された閾値を比較器25に出力させる。

【0042】比較器25は、A/D変換部4を介して入力したポイントcにおける電池電圧と、低温待ち受け時の電池残量レベル4～1（c4～c1）の閾値とを比較し、その結果を制御部23に通知する。制御部23は、比較器25により得られた比較結果から、電池残量が常温時と同じ電池残量レベル2（a2）に相当すると判定する。

【0043】この状態から、通話に入った場合は、電池電圧が電池の特性により低下しポイントdに移行する。制御部23は、待ち受けから通話に変わったことにより、通話時の電池残量を検知させるために切替器27に対して、低温・通話・閾値ROMテーブル30dに格納された閾値を比較器25へ出力させ、比較器25が電池残量の判定に用いる閾値を、待ち受け時の電池残量レベル4～1（c4～c1）から通話時の電池残量レベル4～1（d4～d1）に切り替える。

【0044】この時、制御部23は、比較器25における電池残量レベル4～1（d4～d1）を用いた比較結果をもとに、電池残量が常温時と同じ電池残量レベル2（d2）に相当すると判定する。

【0045】このようにして、電池パック2に設けられたサーミスタ12の電圧を読み取ることで温度を検出し、現在通話中であるか待ち受け中であるかに加えて、常温時であるか低温時であるかに応じて、切替器27によって閾値ROMテーブル30中のテーブル30a～30dを切り替えて比較器25に出力させるので温度変化を考慮した電池残量を判定することができる。従って、温度変化に影響されない電池残量の検出が可能となるので、前述したように通話時、待ち受け時と、常温あるいは低温の組み合わせの何れの状態にあっても、電池残量レベルをレベル2と判定することができる。

【0046】また、低温通話時においても、図2に示す低温通話時の電池残量表示に示すように、電池残量レベル4～1の通話時間の比率が均等になり、電池残量と通

話時間の整合をとることが可能となる。

【0047】なお、前述した説明では、常温時と低温時の2段階の温度を例にして説明しているが、3段階以上の温度を対象とすることも勿論可能である。この場合、閾値ROMテーブル30には、3段階以上の各温度と待ち受けと通話中の組毎に閾値を格納しておき、サーミスタ12を用いて検出された温度に応じて閾値を切り替えて電池残量の判定を行なう。

【0048】また、前述した説明では、携帯電話に設けられた電池残量検出装置を例にして説明しているが、二次電池が設けられた移動通信端末であれば、携帯電話以外の機器に対しても適用することが可能である。

【0049】

【発明の効果】以上詳述したように本発明によれば、移動体通信端末に設けられた二次電池から検出された電池電圧に対して、通信時と待ち受け時と温度の組み合わせ毎に用意された二次電池の残量を判定する際の基準値となる閾値を、通信時と待ち受け時と温度に応じて切り替えることで、通信時と待ち受け時の違いだけでなく、温度によって変化する二次電池の放電特性を考慮した二次電池の残量の判定を行なうので、温度変化による影響を受けずに電池残量を検出することができる。

【図面の簡単な説明】

【図1】本発明の実施の形態における電池残量検出装置を設けた携帯電話の構成例を示す図。

【図2】常温時と低温時の電池パック2の放電特性と、電池残量を判定するための待ち受け時と通話時と温度（常温、低温）の組み合わせ毎の閾値を示す図。

【図3】電池残量を通知するための表示の一例を示す図。

【図4】従来の電池残量検出装置を設けた携帯電話の構成例を示す図。

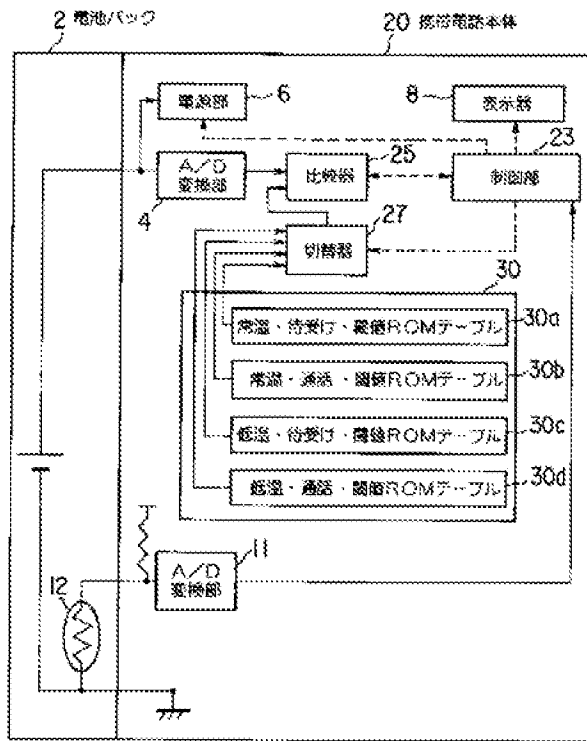
【図5】常温時と低温時の電池パック2の放電特性と電池残量を判定するための待ち受け時と通話時の閾値を示す図。

【符号の説明】

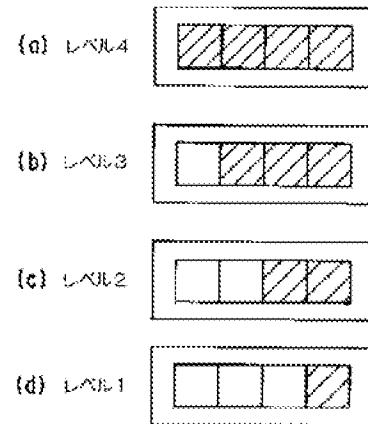
- 2…電池パック
- 4…A/D変換部
- 6…電源部
- 8…表示部
- 11…A/D変換部
- 12…サーミスタ
- 20…携帯電話本体
- 23…制御部
- 25…比較器
- 27…切替器
- 30…閾値ROMテーブル
- 30a…常温・待受け・閾値ROMテーブル
- 30b…常温・通話・閾値ROMテーブル
- 30c…低温・待受け・閾値ROMテーブル

30d…低温・通話・閾値ROMテーブル

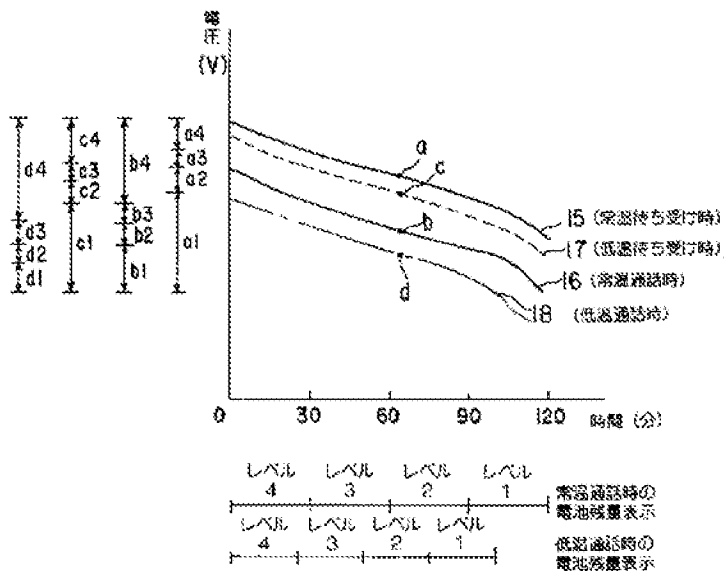
【図1】



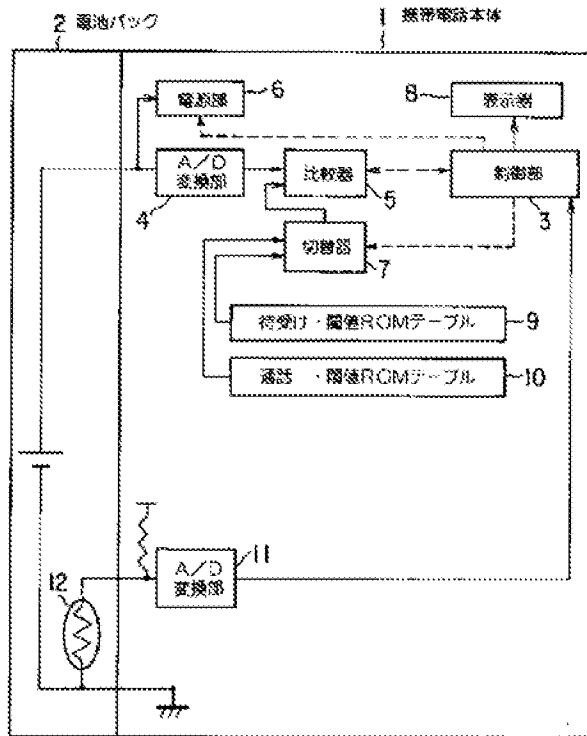
【図3】



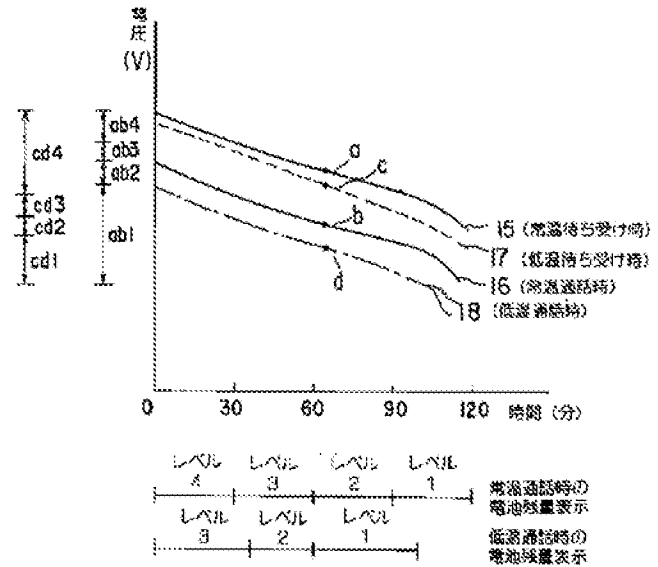
【図2】



【図4】



【図5】



フロントページの続き

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 CC13 CC16 CC27 CC28 CD01
 CE00
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 LA01
 5K067 AA27 AA33 BB04 EE02 FF19
 FF23 KK05 LL11